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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/750,488	12/31/2003	Eric C. Hannah	P18191	1800

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EXAMINER
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HAFIZ, MURSALIN B

ART UNIT	PAPER NUMBER
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2814

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/26/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/750,488	<b>Applicant(s)</b> HANNAH ET AL.	
	<b>Examiner</b> Mursalin B. Hafiz	<b>Art Unit</b> 2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 30 November 2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-6, 13-22, 29-32, 38 and 40-43 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-6, 13-22, 29-32, 38 and 40-43 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Response to Amendment*

1. Applicant's amendment filed on November 30, 2006 is hereby acknowledged.

Claim 41 is amended.

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 41 and 42 are rejected under 35 U.S.C. 102(e) as being anticipated by Chen et al (US 2004/0125565 A1).

Regarding claim 41, Chen et al disclosed in Fig. 1, an apparatus comprising:

a thermal management device [50];

a heat source [30];

a plurality of first nanostructures attached to the thermal management device;

and

a plurality of second nanostructure attached to the heat source, wherein the first nanostructures are interleaved with the second nanostructures wherein the first

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nanostructures and the second nanostructures are disposed in a predetermined pattern [40; paragraph 0019], and wherein the first nanostructures and the second nanostructures include molecules to facilitate adhesion of the first nanostructures and the second nanostructures to each other [end product is interface material in between the heat source and heat management device where nanostructure contacts with the heat source and heat management device; the above limitation does not provide any structural limitation rather it describes how the structure is achieved. Hence, it does not provide any patentable weight].

Regarding claim 42, Chen et al disclosed in paragraph 0018 the thermal management device [50] includes at least one of passive cooling device and active cooling device [heatsink].

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-3, 6, 13, 30, 31, and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al (US 2004/0125565 A1) in view of Edman et al (US 7,060,224 B2).

Regarding claim 1, Chen et al discloses in Fig. 1, an apparatus comprising:  
a thermal management device [50];

a heat source [30]; and

an interface [40] disposed between the thermal management device [50] and the heat source [30], the interface having a plurality of nanostructures [paragraph 0019] the nanostructures having plurality of polymer molecules [paragraph 0019].

chen et al fails to disclose the polymer molecules including deoxyribonucleic acid (DNA) molecules. However, Edman et al teaches nanostructure using DNA. It would have been obvious to one of ordinary skilled in the art at the time of the invention was made to incorporate Edman's teaching into Searls et al's device at least to selectively glue together parts [column 26 lines 15-25].

Regarding claims 2 and 3, Chen et al discloses thermal management device [50] comprises a passive cooling device and passive cooling device comprises at least one of a heat sink, a heat spreader, heat pipes and a heat slug [paragraph 0018].

Regarding claim 6, Searls discloses that the heat source [30] comprises a rectangular piece of silicon material [CPU] [paragraph 0004].

Regarding claims 13, Searls discloses, an apparatus comprising:

a thermal management device [50];

a heat source [30]; and

an interface [40] disposed between the thermal management device [50] and the heat source [30], the interface having a plurality of nanostructures formed on the thermal management device and the heat source, the plurality of nanostructures formed on the thermal management device being coupled to the plurality of nanostructures formed on the heat source, the plurality of nanostructures formed on the thermal

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management device being coupled to the plurality of nanostructures formed on the heat source, wherein the plurality of nanostructures formed on the thermal management device and the plurality of nanostructures formed on the heat source have a plurality of molecules covalently coupling the nanostructures formed on the thermal management device and the plurality of nanostructures formed on the heat source, wherein the plurality of molecules comprises a flexible polymer molecules [paragraph 0019].

Chen et al fails to disclose the flexible polymer comprises deoxyribonucleic acid (DNA) molecules. However, Edman et al teaches nanostructure using DNA. It would have been obvious to one of ordinary skilled in the art at the time of the invention was made to incorporate Edman's teaching into Searls et al's device at least to selectively glue together parts as taught by Edman et al in column 26 lines 15-25.

Regarding claim 30, Chen et al discloses, a semiconductor package comprising:  
a thermal management device [50];  
a heat source [30]; and  
an interface [40] disposed between the thermal management device [50] and the heat source [30], the interface having a plurality of nanostructures the nanostructures having plurality of polymer molecules [paragraph 0019].

Chen et al fails to disclose the polymer molecules including deoxyribonucleic acid (DNA) molecules. However, Edman et al teaches nanostructure using DNA. It would have been obvious to one of ordinary skilled in the art at the time of the invention was made to incorporate Edman's teaching into Searls et al's device at least to selectively glue together parts [column 26 lines 15-25].

Regarding claim 31, Chen discloses thermal management device [50] comprises a passive cooling device [paragraph 0018].

Regarding claim 40, Searls et al disclosed in Fig. 1-3, an apparatus comprising:

a thermal management device [50];

a heat source [30];

a plurality of first nanostructures attached to the thermal management device;

and

a plurality of second nanostructure attached to the heat source, wherein the first nanostructures are interleaved with the second nanostructures wherein the first nanostructures and the second nanostructures, wherein at least one of the plurality of first nanostructures and plurality of second nanostructures includes a plurality of polymer molecules [paragraph 0019; end result is same structure].

Chen et al fails to disclose the polymer molecules including deoxyribonucleic acid (DNA) molecules. However, Edman et al teaches nanostructure using DNA. It would have been obvious to one of ordinary skilled in the art at the time of the invention was made to incorporate Edman's teaching into Searls et al's device at least to selectively glue together parts as taught by Edman et al in column 26 lines 15-25.

4. Claims 4, 5, and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al (US 2004/0125565 A1) and Edman et al (US 7,060,224 B2) in view of Chen et al (US 2005/0059238 A1) herein after Chen(2005).

Regarding claim 4, 5, and 32, Chen et al and Edman et al met all the claimed limitations except, the thermal management device comprises an active cooling device,

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and the active cooling device comprises at least one of an air jet impingement device and a dielectric liquid device. However, Chen(2005) teaches active cooling device can be substitute for a passive cooling device [page 4 paragraph 0039]. So, it would have been obvious to one of ordinary skill in the art at the time of invention to use active cooling device instead of passive cooling device to increase the efficiency of the thermal management device. Chen teaches thermal management device being air jet impingement device [micro-fan device, micropumps] [page 4 paragraph 0039].

5. Claims 14, 38 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al (2004/0125565 A1) in view of Fan et al (US 6,924,335 B2).

Regarding claims 14 and 38, Chen et al does not disclose explicitly nanostructures comprises a plurality of carbon nanotubes. However, Fan et al teaches an analogous device wherein nanostructures comprises a plurality of carbon nanotubes. It would have been obvious to one of ordinary skilled in the art at the time of the invention was made to use carbon in Chen's device at least to provide good thermal conductivity [column 2 lines 1-3]. Moreover, selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co., Inc. v. Interchemical Corp.*, 325 U. S. 327,65 USPQ 297 (1945).

Regarding claim 43, Cheb et al does not disclose explicitly at least one of the plurality of first nanostructure and the plurality of second nanostructures includes a plurality of carbon nanotubes. However, Fan et al teaches an analogous device wherein nanostructures comprises a plurality of carbon nanotubes. It would have been obvious to one of ordinary skilled in the art at the time of the invention was made to use carbon

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in Chen's device at least to provide good thermal conductivity [column 2 lines 1-3].

Moreover, selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co., Inc. v. Interchemical Corp.*, 325 U. S. 327, 65 USPQ 297 (1945).

6. Claims 15, 17-19, 22, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Prasher (US 2005/0105272 A1) in view of Chen et al (US 2004/0125565 A1) and further in view of Edman et al (US 7,060,224 B2).

Regarding claims 15, Prasher discloses in Fig. 6b, a system comprising:

- a wiring board [610];

- a memory device electrically coupled to the wiring board [610] [page 3, paragraph 0037];

- a heat source [624] electrically coupled to the wiring board [610];

- a thermal management device [622 and 602 combined] coupled to the heat source [624]; and

- an interface [626] disposed between the thermal management device [622 and 602 combined] and the heat source [624].

Prasher does not disclose that the interface having a plurality of nanostructures.

However, Chen et al teaches an interface having a plurality of nanostructures, the nanostructures having a plurality of polymer molecules. Nanostructures such as carbon nanotubes have high thermal and electrical conductance. So, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to use

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nanostructures in the interface at least to increase the thermal conductivity or ground the die [paragraph 0007].

Chen et al fails to disclose the polymer molecules including deoxyribonucleic acid (DNA) molecules. However, Edman et al teaches nanostructure using DNA. It would have been obvious to one of ordinary skilled in the art at the time of the invention was made to incorporate Edman's teaching into Searls et al's device at least to selectively glue together parts as taught by Edman et al in column 26 lines 15-25.

Regarding claim 17, Prasher discloses that the memory device comprises a flash type memory device [page 3, paragraph 0037].

Regarding claims 18 and 19, Chen discloses thermal management device [50] comprises a passive cooling device and passive cooling device comprises at least one of a heat sink, a heat spreader, heat pipes and a heat slug [paragraph 0018].

Regarding claim 22, Prasher discloses that the heat source [624] comprises an integrated circuit (IC) die [page 3 paragraph 0035].

Regarding claims 29, Prasher discloses in Fig. 6b, a system comprising:

- a wiring board [610];

- a memory device electrically coupled to the wiring board [610] [page 3, paragraph 0037];

- a heat source [624] electrically coupled to the wiring board [610];

- a thermal management device [622 and 602 combined] coupled to the heat source [624]; and

an interface [626] disposed between the thermal management device [622 and 602 combined] and the heat source [624].

Prasher does not disclose that the interface having a plurality of nanostructures. However, Chen teaches an interface [40] disposed between the thermal management device [50] and the heat source [30], the interface having a plurality of nanostructures formed on the thermal management device and the heat source, the plurality of nanostructures formed on the thermal management device being coupled to the plurality of nanostructures formed on the heat source, the plurality of nanostructures formed on the thermal management device being coupled to the plurality of nanostructures formed on the heat source, wherein the plurality of nanostructures formed on the thermal management device and the plurality of nanostructures formed on the heat source have a plurality of molecules covalently coupling the nanostructures formed on the thermal management device and the plurality of nanostructures formed on the heat source, wherein the plurality of molecules comprises a flexible polymer molecules. Nanostructures such as carbon nanotubes have high thermal and electrical conductance. So, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to use nanostructures in the interface at least to increase the thermal conductivity or ground the die [paragraph 0019; finished structure of prior art is same as the application; ].

Chen et al fails to disclose the polymer molecules including deoxyribonucleic acid (DNA) molecules. However, Edman et al teaches nanostructure using DNA. It would have been obvious to one of ordinary skilled in the art at the time of the invention was

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made to incorporate Edman's teaching into Searls et al's device at least to selectively glue together parts as taught by Edman et al in column 26 lines 15-25.

7. Claims 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over over Prasher (US 2005/0105272 A1), Chen et al (2004/0125565 A1) and Edman et al (US 7,060,224 B2) as applied to claims 15 and 18 above, and further in view of Tobita et al (US 6,730,731 B2).

Regarding claim 16, Prasher, Chen, and Edman met all the claim limitations except, the wiring board comprises a printed circuit board. However, Tobita teaches an analogous device where printed circuit board is used in place of wiring board. It is well known in the art to use printed circuit board for putting all the components together such as motherboard of computer that contains processor with heat sink, memory etc.

8. Claims 20 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Prasher (US 2005/0105272 A1), Chen et al (2004/0125565 A1) and Edman et al (US 7,060,224 B2) as applied to claims 15 and 18 above, and further in view of Chen et al (US 2005/0059238 A1).

Regarding claim 20 and 21, Prasher, Chen, and Edman met all the claimed limitations except, the thermal management device comprises an active cooling device, and the active cooling device comprises at least one of an air jet impingement device and a dielectric liquid device. However, Chen teaches active cooling device can be substitute for a passive cooling device [page 4 paragraph 0039]. So, it would have been obvious to one of ordinary skill in the art at the time of invention to use active cooling device instead of passive cooling device to increase the efficiency of the thermal

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management device. Chen teaches thermal management device being air jet impingement device [micro-fan device, micropumps] [page 4 paragraph 0039].

***Response to Arguments***

Applicant's arguments with respect to claims 1-6, 13-22, 29-32, 38, and 40-43 have been considered but are moot in view of the new ground(s) of rejection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mursalin B. Hafiz whose telephone number is 571-272-8604. The examiner can normally be reached on m-f 9-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on 571-272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Mbh



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PRIMARY PATENT EXAMINER